

Muscle Microstructure

Muscle - large complex bundle of fibres surrounded by Fascia and a layer of Epimysium

Fasciculus- smaller compartments containing thousands of muscle fibres
- surrounded by Perimysium

Muscle Fibres - the individual muscle cell

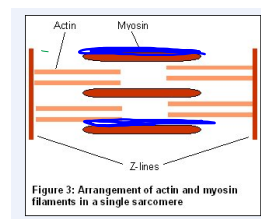
- fuses with the tendon
- surrounded by the Sarcolemma

Myofibrils - several thousand myofibril contained in each muscle cell

Filaments
- contained in each myofibril are filaments of Actin and Myosin and are seen in the striations (light and dark bands) of the muscle fibre

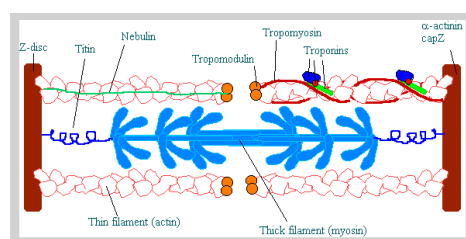
Sliding Filament Theory

-Myosin heads create cross bridges attaching to actin, and if the nerve impulse is strong enough, then the myosin pulls the two actin filaments close together, thus shortening the length of the muscle fibre. The muscle fibres become thicker due to the overlapping of filaments.



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Muscle Contraction

- a nerve carrying an impulse, releases a transmitter called acetylcholine across the neuromuscular junction
- acetylcholine causes calcium ions to be released from the cell membrane
- a bridge-like system is set up between the actin and myosin filaments
- with calcium and ATP, the filaments slide over each other causing the fibres to shorten and the muscle contracts
- muscle contract completely or not at all (All or None Principle)
- *all fibres in a motor unit get the exact same stimulation*
- *all fibres react maximally when threshold is met*
- *Gross Motor Movement- many units stimulated*
- *Fine Motor Movement- few units stimulated*

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Functional Organization of Skeletal Muscle

Muscle Fibres:

- threadlike shape
- size: wide range of length and diameter
- ✓ • growth in length and diameter
- ✓ • no change in the # of fibres
- Twitch(< 100 ms) vs. Tetanus
- ✓ (a) twitch: response to a single stimulus
- ✓ (b) tetanus: state of muscle producing sustained maximal tension due to repeated stimulus

Innervation of Muscle Fibres

Motor Unit:

- single motorneuron + muscle fibres innervated
- functional unit of muscle
- number of fibres in a unit
- ✓ (a) smaller: fine movement- muscles of the eye
- ✓ (b) larger: gross & powerful movement- gastrocnemius

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Muscle Fibre Types

Muscle Fibres have been classified by function into slow twitch (type I) and fast twitch (type II). Most skeletal muscles are composed of both types of fibres, although one type may predominate.

- The slow-twitch, darker-hued muscle fibres have greater endurance

Slow Twitch (Type I, Slow-twitch Oxidative; SO): (red)

- (a) longer max tension time
- (b) lower tension
- (c) high endurance

- The fast twitch, lighter-hued muscle fibres ~~contract~~ more rapidly and produce bursts of power (white)

Fast twitch (FT, Type II):

- (a) shorter maximum tension time
- (b) higher tension
- (c) fatigue quickly
- (d) sub types:

Type II a (Fast-Twitch Oxidative Glycolytic; FOG)

Type II b (Fast Twitch Glycolytic; FG)

 Intervals

Some people are genetically predisposed to have more of one type of muscle type than the other
ie. an Olympic level marathon runner would have 75-95% of her fibres as slow twitch fibres within her muscles.
Conversely, an Olympic sprinter could have 75-90% of her fibres as fast twitch. The general population tends to have around 60-40% split

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Muscle Type - Reading Assignment

p90-93

Read and answer the following questions

1) Compare and contrast the 3 Muscle Fibre Types

2) How does the fibre composition affect an athletes ability to perform an activity?

3) What training methods or schedules are presented for each fibre type?

4) What are phasic and tonic muscles? Give examples of each the human body?

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